CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1-29 (previously cancelled)
30-31 (cancelled)

32. (New): A method of forming/defining and solving a model of a power network to affect control of voltages and power flows in a power system, comprising the steps of:

obtaining on-line/simulated data of open/close status of switches and circuit breakers in a power network, and reading data of operating limits of a power network components including PV-node, a generator-node where Real-Power-P and Voltage-Magnitude-V are given/assigned/specified/set, generators maximum and minimum reactive power generation capability limits and transformers tap position limits,

obtaining on-line readings of given/assigned/specified/set real and reactive power at PQ-nodes, the load-nodes where Real-Power-P and Reactive-Power-Q are given/assigned/specified/set, real power and voltage magnitude at PV-nodes, voltage magnitude and angle at the reference/slack node, and transformer turns ratios, which are the controlled variables/parameters,

initiating loadflow calculation with initial approximate/guess solution of the same voltage magnitude and angle as those of the reference/slack node for all the other nodes referred to as the slack-start,

forming and storing factorized gain matrices [Yθ] and [YV] using the same indexing and addressing information for both as they are of the same dimension and sparsity structure, wherein said [Yθ] relate vector of modified real power mismatches [RP] to angle corrections vector [Δθ] in equation [RP] = [Yθ] [Δθ] referred to as P-θ sub-problem, and said [YV] relate vector of modified reactive power mismatches [RQ] to voltage magnitude corrections vector [ΔV] in equation [RQ] = [YV] [ΔV] referred to as Q-V sub-problem,

restricting transformation/rotation angle Φ_p to maximum -48° in determining transformed real and reactive power mismatch as,

$\Delta P_p' = \Delta P_p Cos\Phi_p + \Delta Q_p Sin\Phi_p$ -for PQ-nodes (23)

$\Delta Q_p' = \Delta Q_p Cos\Phi_p - \Delta P_p Sin\Phi_p$ -for PQ-nodes (24)

Wherein, ΔP_p and ΔQ_p are real and reactive power mismatches at node-p,

calculating modified real and reactive power mismatches as given in the following in the most general form of equations that take different form for different Super Super Decoupled Loadflow model:

$RP_p = [\Delta P_p' + (G_{pp}'/B_{pp}')\, \Delta Q_p'] / V_p^2$ -for PQ-nodes (17)

$RQ_p = [\Delta Q_p' - (G_{pp}'/B_{pp}')\, \Delta P_p'] / V_p$ -for PQ-nodes (18)

and calculating modified real power mismatch at a PV-node as,

$RP_p = \Delta P_p/(K_p V_p^2)$ -for PV-nodes (19)

Wherein, K_p = Absolute $(B_{pp}/Y\theta_{pp})$ (29)

and V_p is voltage magnitude at node-p, and B_{pp} is imaginary part of the diagonal element Y_{pp} of the admittance matrix without network shunts, and $Y\theta_{pp}$ is the diagonal element of the gain matrix $[Y\theta]$,

using network shunt parameter $\mathbf{b_p'}$ that appears in diagonal elements of gain matrix [YV] as given in the following in the most general form of equations that take different form for different loadflow model:

$b_p' = -b_p Cos\Phi_p + [QSH_p' - (G_{pp}'/B_{pp}')\, PSH_p'] / V_s^2$ **or**

$b_p' = 2[QSH_p' - (G_{pp}'/B_{pp}')\, PSH_p'] / V_s^2$ (22)

wherein, G_{pp}' and B_{pp}' are the real and imaginary parts of the transformed diagonal element Y_{pp}' of the admittance matrix without network shunts, b_p is network shunt susceptance at node-p, V_s is slack-node voltage magnitude, and

$PSH_p' = PSH_p Cos\Phi_p + QSH_p Sin\Phi_p$ -for PQ-nodes (25)

$QSH_p' = QSH_p Cos\Phi_p - PSH_p Sin\Phi_p$ -for PQ-nodes (26)

wherein, PSH_p, and QSH_p are given/specified/scheduled/set real and reactive power respectively,

performing loadflow calculation by solving a Super Super Decoupled Loadflow model of a power network defined by set of equations [RP] = [Yθ] [Δθ] and [RQ] = [YV] [ΔV] employing successive (1θ, 1V) iteration scheme, wherein each iteration involves one calculation of [RP] and [Δθ] to update voltage angle vector [θ] and then one calculation of [RQ] and [ΔV] to update voltage magnitude vector [V], to calculate values of the voltage angle and the voltage magnitude at PQ-nodes, voltage angle and reactive power generation at PV-nodes, and turns ratio of tap-changing transformers in dependence on the set of said obtained-online readings, or given/scheduled/specified/set values of controlled variables/parameters and physical limits of operation of a power network components,

evaluating loadflow calculation for any of the over loaded power network components and for under/over voltage at any of a power network nodes,

correcting one or more controlled parameters and repeating the calculating, performing, evaluating, and correcting steps until evaluating step finds no over loaded components and no under/over voltages in a power network, and

affecting a change in the power flowing through network components and voltage magnitudes and angles at the nodes of a power network by actually implementing the finally obtained values of controlled variables/parameters after evaluating step finds a good power system or alternatively a power network without any overloaded components and under/over voltages, which finally obtained controlled variables/parameters however are stored in case of simulation for acting upon fast in case the simulated event actually occurs.

33. (New): A method as defined in claim-32 wherein loadflow calculation involving formation and solution of super super decoupled loadflow model, employing simultaneous (1V, 1θ) iteration scheme is characterized in that it involve only one time calculation of real and reactive power mismatches in an iteration along with modified real power mismatch calculation, depending on super super decoupled loadflow model used, either by:

$$RP_p = [(\Delta P_p/V_p) - \sum_{q=1}^{m} G_{pq}\Delta V_q] / V_p$$ -for all nodes **or** (74)

$$RP_p = [(\Delta P_p/V_p) - \sum_{q=1}^{m} G_{pq}\Delta V_q - (g_p'\Delta V_p)] / V_p$$ -for PQ-nodes, and (75)

$$RP_p = [(\Delta P_p/V_p) - \sum_{q=1}^{m} G_{pq}\Delta V_q] / V_p$$ -for PV-nodes (76)

OR

$$RP_p = [\{[\Delta P_p' + (G_{pp}'/B_{pp}')\Delta Q_p'] / V_p\} - (g_p'\Delta V_p)] / V_p$$ -for PQ-nodes (92)

$$RP_p = [(\Delta P_p/V_p) - \sum_{q=1}^{m} G_{pq}\Delta V_q] / (K_p{*}V_p)$$ -for PV-nodes (93)

wherein, m is the number of PQ-nodes, and the symbol 'Δ' preceding any variable represents mismatch or correction in the variable.